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Having at first given an account of the nutrition characteristic of ruminants, and having established the importance of the microbial flora in the rumen for the production of proteins, the lecturer proceeded to give a report on the above-mentioned investigations performed during a year and a half. When the experiment was started, it was uncertain whether the protein synthesis by bacteria which occurs in the rumen could be made so vigorous that continuous milk production without feeding proteins would be possible. Purified starch, sucrose, and α-cellulose (pure sulphite cellulose) were used as energy nutrients for the cows (Ayrshire). A small amount of maize oil (on the average 18 to 34 g per cow per day) was added to the feed to supply poly-unsaturated fatty acids. Urea and a small amount of ammonium sulphate and ammonium phosphate were the sources of nitrogen. The mineral mixture contained all the 16 elements known to be indispensable for animals, selenium included. In addition to vitamin E, contained in the maize oil, pure A and D vitamins were given to the cows. Other vitamins were not given. The coarse fodder, which is regarded as important for the functioning of the rumen, presented difficulties in the arrangement of the feeding. In the beginning the test cows had to be given 1 to 3 kg of washed rye straw or winter-wheat straw. These are now successfully substituted by cellulose strips dipped in sodium silicate solution and then in acid solution to precipitate silicic acid on the strips.

The test cows were gradually accustomed to the test feeding while becoming or being dry. Lengthy experience with this test feeding on two milking cows has been obtained. The first cow calved on May 11, 1962. After calving, it has produced 1.939 kg of milk with 5.6 % fat during 299 days. It will calve again in the beginning of May of this year. The second cow calved on October 3, 1962, and has so far produced 1.242 kg of milk with 6.3 % fat during 154 days. Before calving, the production on the same feeding was 386 kg of milk with 4.5 % fat during the period 25th April to 27th August when it went dry. Two other cows were included in the experiment at the end of last year.

The amino acid composition of the proteins in the test milk is according to the analyses made so far the same as that in milk produced on ordinary feeding. The content of water-soluble vitamins of the B group (thiamine, riboflavin, biotin, pyridoxine, and nicotinic acid) was on the same or a considerably higher level (riboflavin, nicotinic acid) in the test milk than in ordinary milk. Other vitamins of the B group were not yet determined. The ability of the rumen microbes to synthesize vitamins of the B group seems to be great. The content of ascorbic acid was normal or somewhat higher than in ordinary milk.

The protein-free diet is based exclusively on the ability of rumen microbes to synthesize the essential amino acids. In order to elucidate which amino acid is most difficultly synthesized, in other words forms the bottleneck in protein synthesis, urea labelled with the heavy nitrogen isotope (^{15}N) was fed to one of the cows. The experiment is not yet finished, but histidine has already been shown to have the lowest labelling of all amino acids of the milk proteins. Milk production attained by the aid of the microbial flora in the rumen cannot compare with the 4.000 to 5.000 kg of milk per year obtained by good dairy cows when protein-rich fodder is fed. In this case, however, the formation of

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animal protein from plant protein is in question and not an initial synthesis of amino acids and protein.

The feeding of dairy cows on purified energy nutrients and simple nitrogen compounds has opened up new possibilities of elucidating the formation of different compounds in milk. The test milk is necessary especially for the elucidation of the origin of flavour substances in milk. It was surprising to find how little the taste and smell of the test milk differs from that of milk produced on ordinary feeding.

The unexpectedly high production of milk obtained on the test feeding even with the two first cows, is of practical interest too. If a cheap, sufficiently digestible carbohydrate feed can be prepared from straw, wood, sugar cane waste, or from other fast-growing plants of the same kind, or even synthetically, it may be possible to remove by milk production protein and vitamin deficiency in the vast areas inhabited by undernourished peoples.

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